



AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listing, of claims in the application.

Claims 1-10 (Cancelled).

11. (Currently amended) ~~The Bernoulli end effector of claim 1,~~ A Bernoulli end effector comprising:

a support member defining at least one passage for directing a fluid at a substrate to apply a holding force and a drag force on the substrate, wherein the hold force is first applied and the drag force is applied after a delay of between about 100 ms and 250 ms;
at least one edge guide protruding from a first surface of the support member for contacting an edge of the substrate to oppose the drag force applied by the fluid; and
at least one friction pad attached to the first surface of the support member for contacting a surface of the substrate to impede a rotational motion of the substrate.

Claim 12 (Cancelled).

13. (Currently amended) ~~The method of claim 12,~~ A method for handling a substrate with a Bernoulli end effector, the method comprising:

directing a fluid at the substrate to apply a holding force and a drag force to the substrate, the holding force creating a low pressure Bernoulli force to lift the substrate, wherein the hold force is first applied and the drag force is applied after a delay;
applying a counter force to an edge of the substrate to oppose the drag force; and
applying a frictional force to a surface of the substrate adjacent to the edge of the substrate to impede a rotational motion of the substrate.

14. (Original) The method of claim 13, wherein the delay is between about 100 ms and 250 ms.

15. (Original) A method for handling a substrate with a Bernoulli end effector, the method comprising:

directing a fluid at the substrate to apply a holding force to the substrate, the holding force creating a low pressure Bernoulli force to lift the substrate;
applying a drag force after applying the holding force; and
applying a counter force to an edge of the substrate to oppose the drag force.

16. (Original) The method of claim 15, wherein the drag force is applied between about 100 ms and 250 ms after the holding force is applied.

17. (Original) The method of claim 15, further comprising applying a frictional force to a surface of the substrate adjacent to the edge of the substrate to impede a rotational motion of the substrate.

Claims 18-50 (Withdrawn).

51. (Cancelled).

52. (Currently amended) — ~~The A Bernoulli end effector comprising: of claim 51, further comprising~~

means for directing a fluid at a substrate to apply[[ing]] a hold[[ing]] force and a drag force to the substrate, the holding force creating a low pressure Bernoulli force to lift the substrate;

means for first applying the hold force and then applying the drag force;

means for applying a counter force to an edge of the substrate to oppose the drag force;

and

means for applying a frictional force to a surface of the substrate adjacent to the edge of the substrate to impede a rotational motion of the substrate.

Claims 53-58 (Withdrawn).

59. (New) The method of claim 13 further comprising contacting the edge of the substrate with an edge guide of the Bernoulli end effector to apply the counter force.

60. (New) The method of claim 13 further comprising using a friction pad of the Bernoulli end effector to apply the frictional force.

61. (New) The method of claim 13 further comprising using a first plurality of passages symmetrically arranged about an axis of a support member of the Bernoulli end effector to apply the hold force.

62. (New) The method of claim 13 further comprising using a second plurality of passages asymmetrically arranged about an axis of a support member of the Bernoulli end effector to apply the drag force.

63. (New) The method of claim 13 further comprising contacting the substrate within 2 mm of the edge of the substrate using a friction pad of the Bernoulli end effector.

64. (New) The method of claim 13 further comprising:
 deliver the substrate using the Bernoulli end effector to a first substrate chuck; and
 receiving the substrate using the Bernoulli end effector from a second substrate chuck to which the substrate is transferred.

65. (New) The method of claim 15 further comprising contacting the edge of the substrate with an edge guide of the Bernoulli end effector to apply the counter force.

66. (New) The method of claim 15 further comprising using a first plurality of passages symmetrically arranged about an axis of a support member of the Bernoulli end effector to apply the hold force.

67. (New) The method of claim 15 further comprising using a second plurality of passages asymmetrically arranged about an axis of a support member of the Bernoulli end effector to apply the drag force.

68. (New) The method of claim 15 further comprising contacting the substrate within 2 mm of the edge of the substrate using a friction pad of the Bernoulli end effector.

69. (New) The method of claim 15 further comprising:

deliver the substrate using the Bernoulli end effector to a first substrate chuck; and
receiving the substrate using the Bernoulli end effector from a second substrate chuck to which the substrate is transferred.

70. (New) The method of claim 17 further comprising using a friction pad of the Bernoulli end effector to apply the frictional force.

71. (New) The Bernoulli end effector of claim 52 wherein the means for directing the fluid at the substrate comprises a support member defining a first plurality of passages symmetrically arranged about an axis of the support member to apply the hold force.

72. (New) The Bernoulli end effector of claim 52 wherein the means for directing the fluid at the substrate comprises a support member defining a second plurality of passages asymmetrically arranged about an axis of the support member to apply the drag force.

73. (New) The Bernoulli end effector of claim 52 wherein the means for applying the counter force comprises at least one edge guide attached to a first surface of the support member.

74. (New) The Bernoulli end effector of claim 52 wherein the means for applying the frictional force comprises at least one friction pad attached to a first surface of the support member.

75. (New) The Bernoulli end effector of claim 71 wherein the first plurality of passages are arranged in a circular pattern for providing a Bernoulli force perpendicular to a surface of the substrate.

76. (New) The Bernoulli end effector of claim 72 wherein the second plurality of passages are arranged in an arc for providing the drag force on the substrate.

77. (New) The Bernoulli end effector of claim 70 wherein the at least one friction pad contacts the substrate within 2 mm of an edge of the substrate.

78. (New) The Bernoulli end effector of claim 77 wherein the at least one friction pad comprises an elastomer.

79. (New) The Bernoulli end effector of claim 77 wherein the at least one friction pad comprises alumina.

80. (New) The Bernoulli end effector of claim 52 wherein the means for first applying the hold force and then applying the drag force is adapted to apply the drag force after a delay of between about 100 ms and 250 ms.

81. (New) The Bernoulli end effector of claim 11 wherein the at least one passage comprises a first plurality of passages symmetrically arranged about an axis of the support member and a second plurality of passages asymmetrically arranged about the axis of the support member.

82. (New) The Bernoulli end effector of claim 81 wherein the first plurality of passages are arranged in a circular pattern for providing a Bernoulli force perpendicular to a surface of the substrate.

83. (New) The Bernoulli end effector of claim 81 wherein the second plurality of passages are arranged in an arc for providing the drag force on the substrate.

84. (New) The Bernoulli end effector of claim 11 wherein an angle between a direction defined by the at least one passage and a surface of the support member is at least approximately thirty degrees.

85. (New) The Bernoulli end effector of claim 11 wherein the at least one friction pad contacts the substrate within 2 mm of an edge of the substrate.

86. (New) The Bernoulli end effector of claim 11 wherein the at least one friction pad comprises an elastomer.

87. (New) The Bernoulli end effector of claim 11 wherein the at least one friction pad comprises alumina.

88. (New) The Bernoulli end effector of claim 11 wherein the at least one edge guide is beveled.